What's New in Topside Paint?

Surface Navy Association, Arlington, VA

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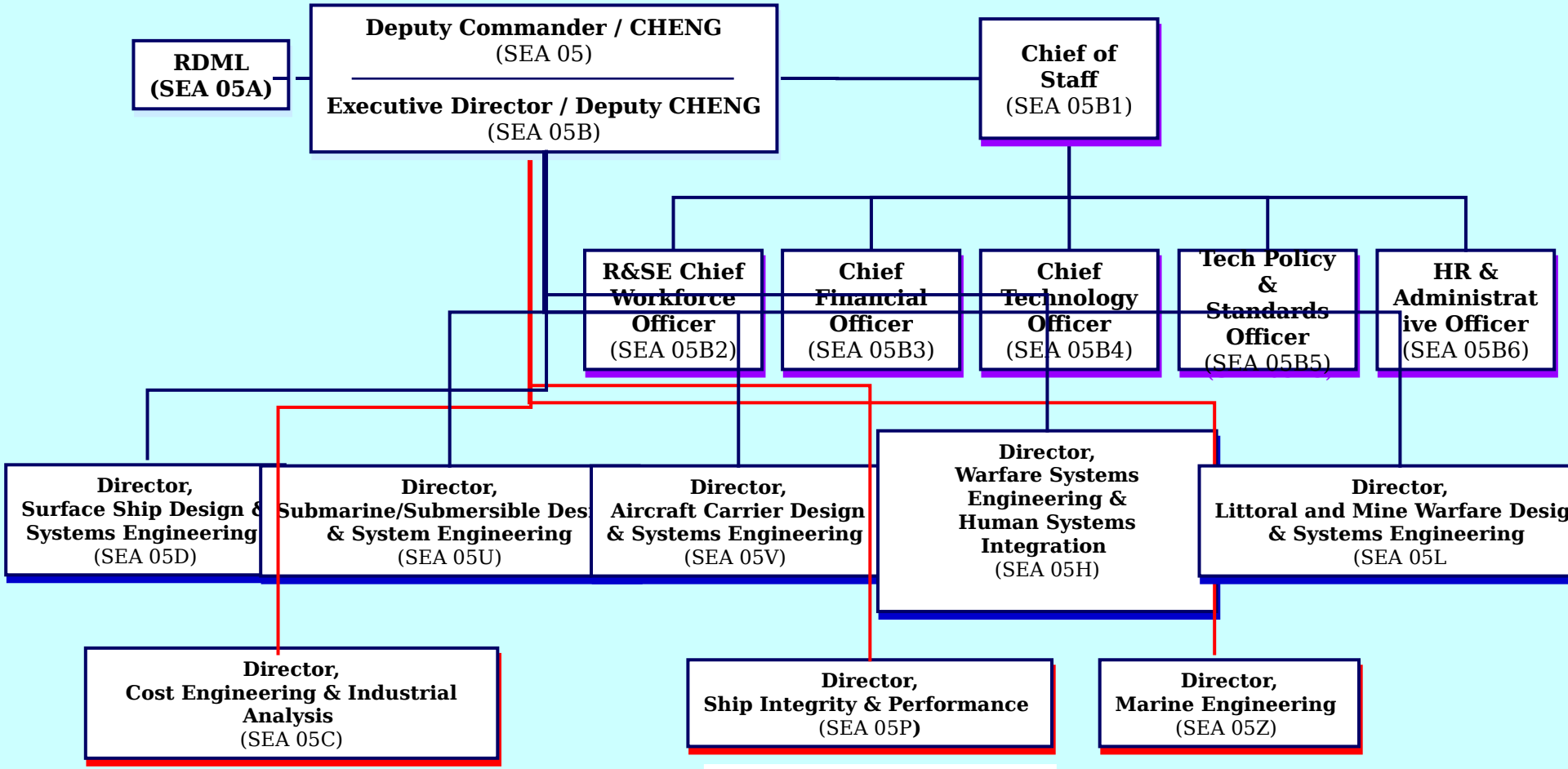
Introduction

- Brief background and history of Navy surface-ship topside coatings.
- NAVSEA success with improving color stability, durability, and service life of topside paints.
- Surface Fleet opportunities for reducing total ownership cost of surface-ship topside coatings.

Problem

Solution

Naval Systems Engineering Directorate (SEA 05)



SEA 05PB - Deputy

SEA 05P2 - Materials
Coatings & Corrosion Control
Cathodic Protection
Composites Materials
Welding & Metals
Non-destructive testing
Fuels and Lubricants

Pre-decisional

Topside Coating History

- **Navy topside coatings developed over decades:**

  •• Sept. 1941 – Bureau of Ships includes "haze gray" color in palette for surface ship camouflage.
  1952 – modern haze gray color adopted.

  •• June 1963 – NAVSHIPS report concludes semi-gloss "haze gray" color is best:
  "from pole to pole, all seasons, around the clock."
  - Color intended to conceal ship against background sea & sky.
  - Mast and stacks black to hide soot.
  - Numbers white & black.

10) - 1943

  •• Sept. 1989 – NAVSEA report based on visual tests, interviews, and photographs showed benefits of reduced contrast by entire topside being haze gray, light gray and ocean gray.

  •• Sept. 1992 – NAVSEA "*Camouflage Manual for Surface Ship Concealment*" published and requires haze gray and counter-shading.

2010

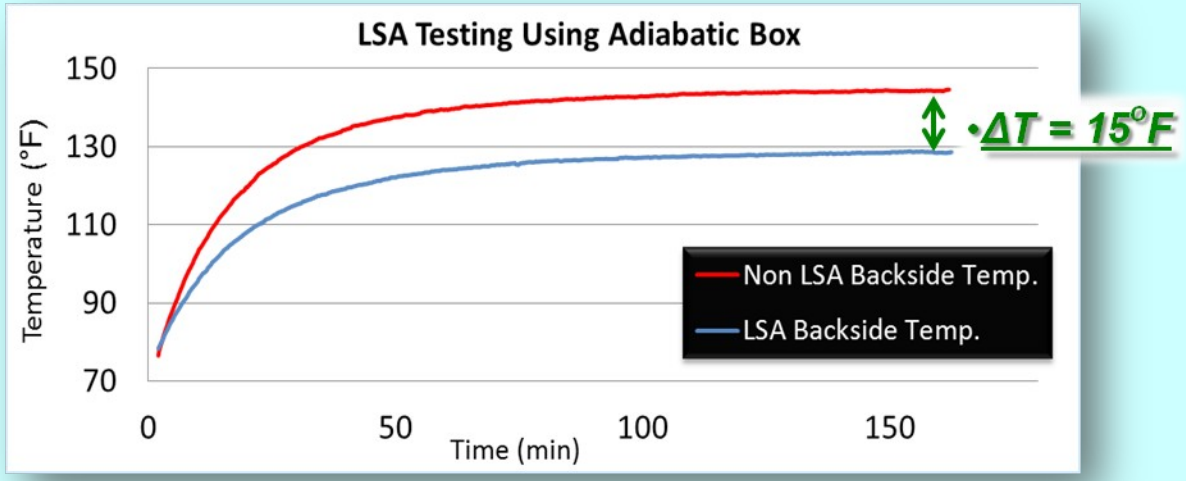
Introduction of Low Solar Absorbance Topside Coatings

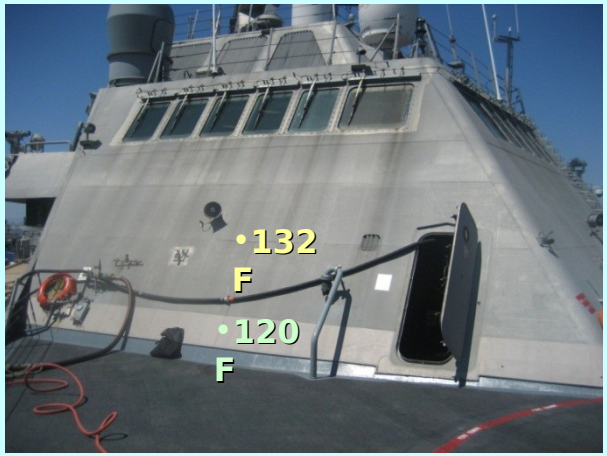
- Low solar absorbance (LSA) topcoats developed by Naval Research Laboratory (NRL) in late 1990s to reduce heat load on DD-963s operating in Persian June, 2000 first LSA paint installed on ex-USS FLETCHER (DD-992). LSA pigments are a commercial, business.

- LSA topcoat applied to entire freeboard and superstructure. NRL measured 6°F reduction in surface temperature on DD-963 structure.

DD-963s operated in Persian Gulf without expensive air-conditioning plant upgrade.

- LSA coatings on lower portion of LCS-1 superstructure compared with uncoated

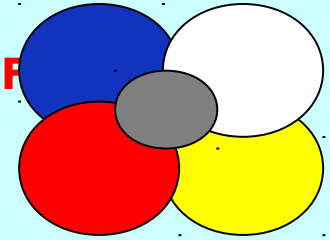




LSA paint required since 2002, reducing ship energy consumption when air conditioning operational

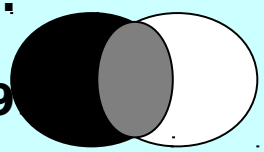
So Why Do LSA Paints Fade?

PROBLEM: First Generation LSA paints are color shifting in F



LSA Pigment

- **LSA topcoats developed in late 1990s entered a world in which over-coating paint was common.**
  - **Crew over-coating common.**
  - **Ships docked 3-5 years and were repainted.**
  - **41 coats of paint on some areas of 49 year old ship.**

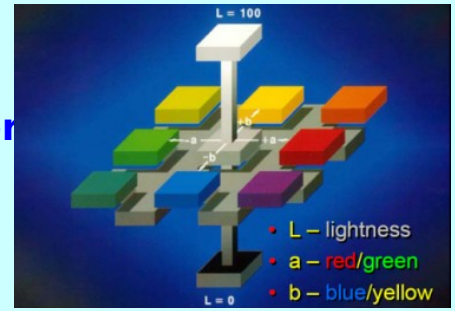


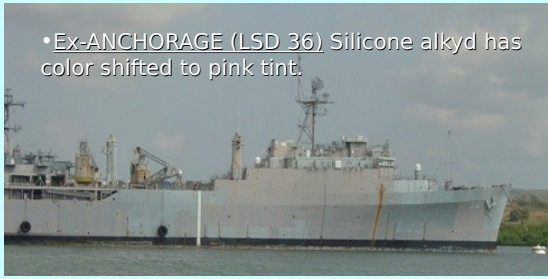
Non-LSA Pigment

- **Topside coating military specification, MIL-PRF-24635B (19 required color & gloss testing:**
  - **One year, Florida, 45°-south.**
  - **60° Gloss not less than 50% of original.**
  - **CIE color values as per ASTM-D-2244**

delta E shall be not greater than 1.0 CIELAB unit

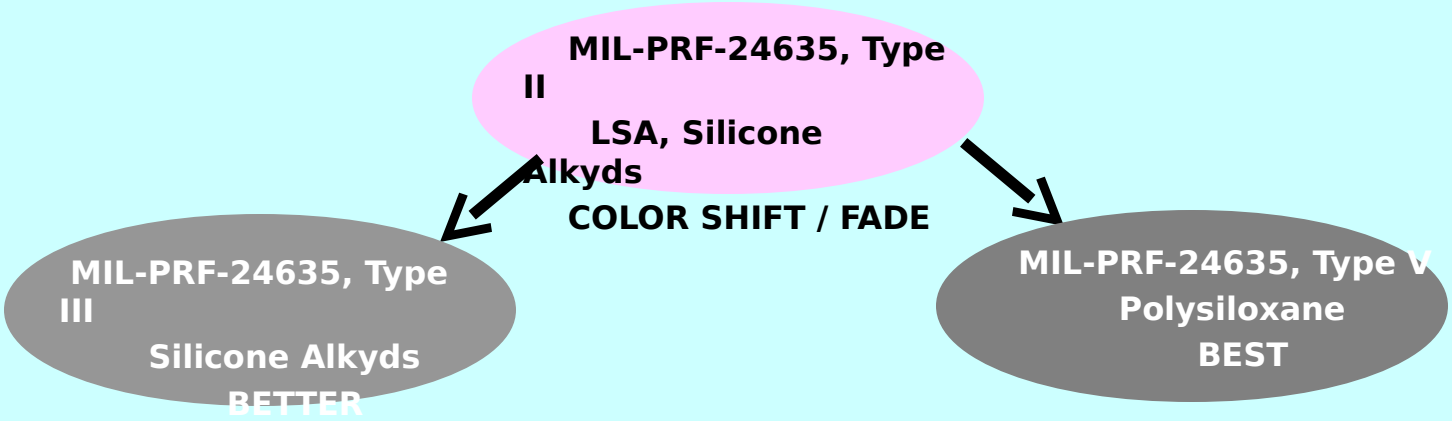
delta E >4 easy to perceive - <1 hard to per





First Generation LSA paint never qualified for long-term service

Solutions to Fading Paint in Place



Nov. 2011 Four Products on QPD **May 2010 Three Products on QPD**

Dec. 2010 NAVSEA Naval Message 131732Z Dec 10 provides paint procurement guidance to Fleet:

Type II - NO LONGER AUTHORIZED – USE UP STOCK

Type III - RECOMMENDED

Type V – RECOMMENDED with EXTREMELY HIGH FADE RESISTANCE

Universal paint requirements document, FY-12, Change 1, Standard Item 009-32 includes process for installing polysiloxane coating – only allows use of BETTER or BEST.

- **NSWC-SSES Naval Message 131500Z SEP 12 describes processes for repairing polysiloxane and over-coating existing paint – all ships in fleet can use BEST paint.**

Must be careful because polysiloxane is two-part paint that requires mixing.

NAVSEA has solution in place to resolve topside fading issue

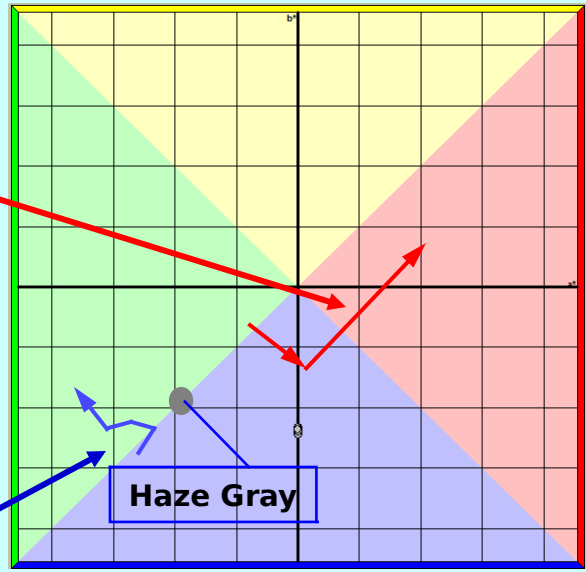
Long-term Ship Tests Prove Concept

- First LSA demonstration, USS PONCE (LPD-5) in 2006.
- Data collection on USS KEARSARGE (LHD-3) signal shack install from MAY 2008. Color shift in excess of 1 Delta E.

Approximate color shift of Type II alkyd (red)

Delta E

>6



Approximate color shift of Type V polysiloxane (blue)

Delta E

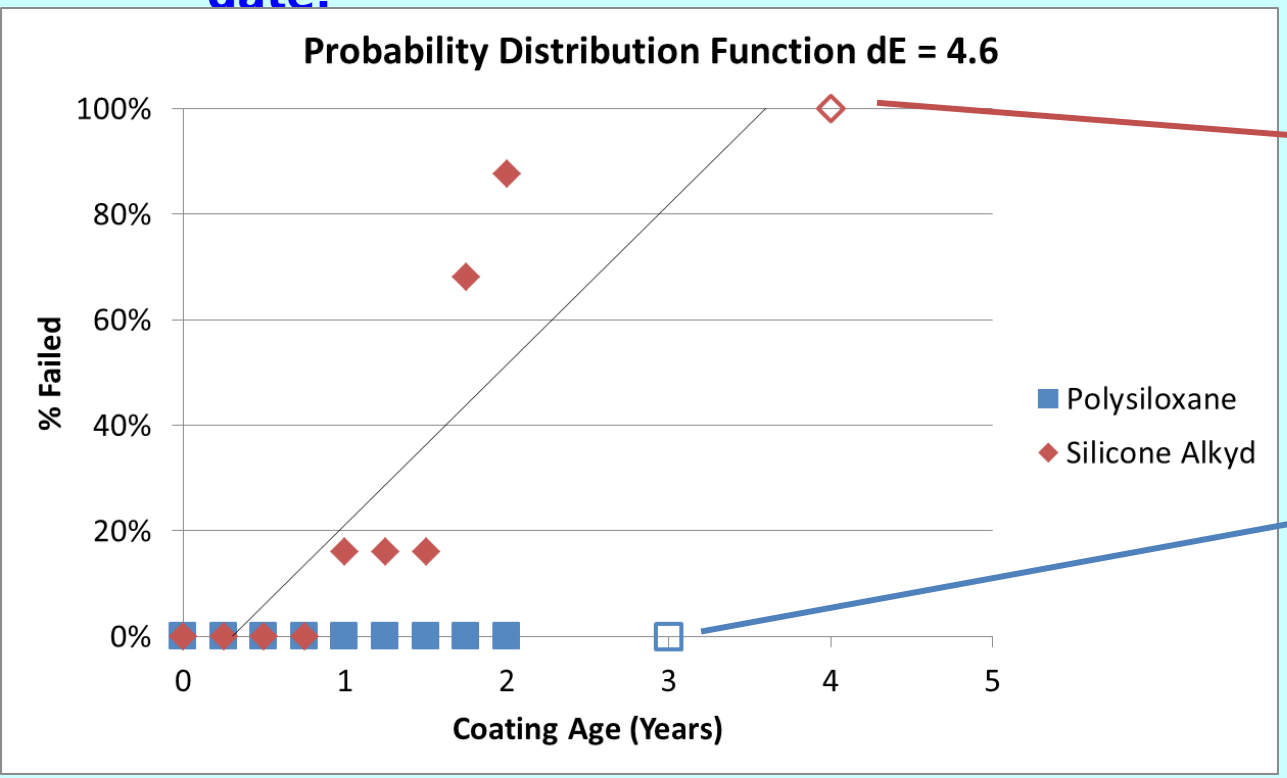
>2.05

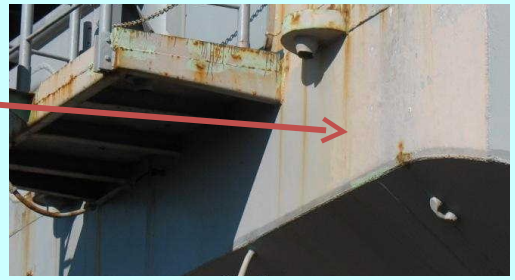
Polysiloxane on USS KEARSAGE (LHD-3) exhibited Color Shift – difficult to perceive

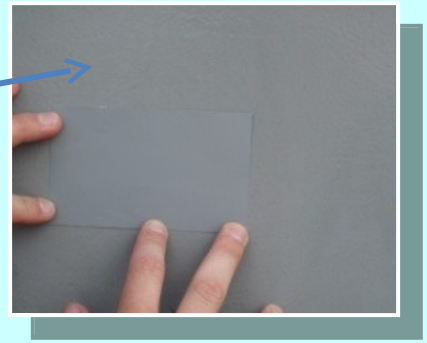
Reducing Probability of Topside Coating Failure

- **NAVSEA defined "failure" of a topside paint as when color obviously faded**
  Delta E = 4.6 is "failure" based on color measurement instrument vector math.

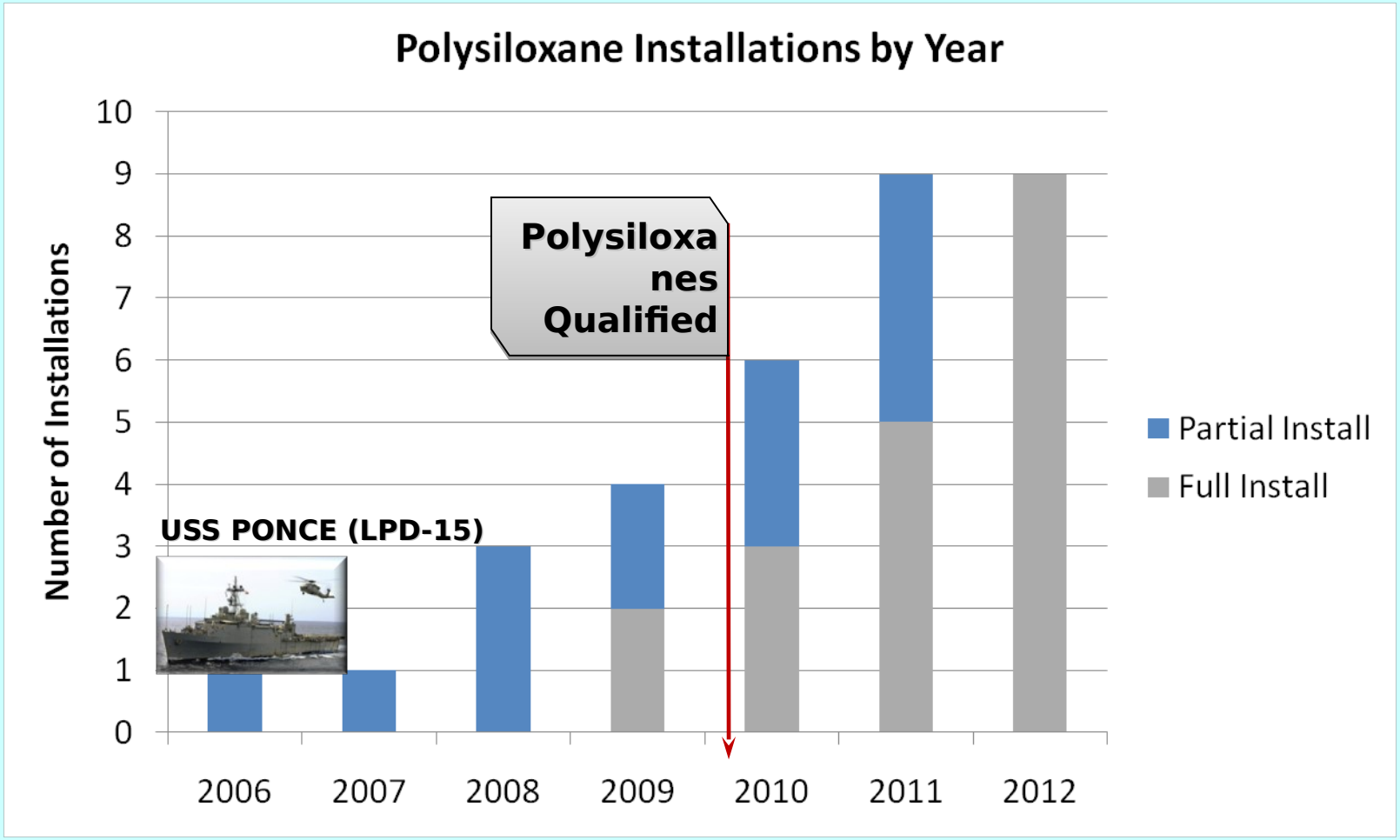
- **Panel & ship data measured quarterly (as available).**
  - **Silicone alkyds show a high probability of failing between 2 and 3 years**
  - **Polysiloxanes show negligible probability of unacceptable color shift to date.**







Polysiloxane Use Expanding In Fleet



Ships want the polysiloxane coatings and NAVSEA Corrosion Control Assistance Teams support Fleet

Polysiloxane is Reducing Install & Total Ownership Costs

- Polysiloxane is a premium-priced paint, but durable and color stable. Coating provides both corrosion-control and topside functionality.

- FY-12, Change 1, Standard Item 009-32 requires polysiloxane coating application with one fewer coat than alkyd.

Silicone Alkyd		Polysiloxane
Epoxy Primer	Steps	Epoxy Primer
Epoxy Stripe Coat		Epoxy or Polysiloxane Stripe Coat
Epoxy Primer		Polysiloxane Topcoat
Silicone Alkyd Topcoat		

- Business case developed based on coating 310,000 square foot LHD topside. materials, & labor:

	Silicone Alkyd	Polysiloxane		
Paint Material Cost	$160,580		$212,350	(less epoxy, thicker film)
Labor & QA	$569,625		$325,500	
TOTAL ESTIMATED JOB COSTS	$730,205	$537,850		

Estimated 26% application cost reduction on LHD topside coating.

What can Fleet Do to Reduce Maintenance Costs?

- **NAVSEA needs fleet help to change the model for topside maintenance.**
  - **Clean the ship (like your car).**
  - **Don't repaint the ship (like your house).**

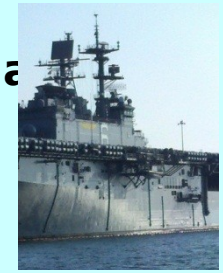
Sailor and Bosun's Mate provided positive feedback on ease of cleaning

Cleaning success on:
CVN-71
DDG-79
LHD-1
LSD-41

- **SEA 21 is developing Lead Ship Initiative to get all new coatings & corrosion-control technology, including polysiloxane, on one ship to demonstrate savings**

- **We need to avoid repainting. Nov. 2012 inquiry from supply officer on ship rec… coated … olysiloxane requested source for a… lkyd paint to overcoa…**

Polysiloxane coating applied to ship in 2010



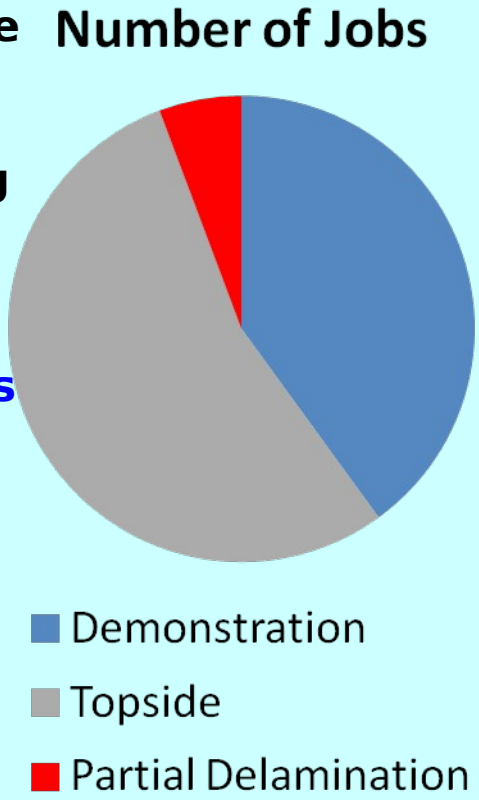
Multiple areas under catwalk over-coated with alkyd by 2012.

Backup slides

Paint Application Process Control is Key

- **Installations of polysiloxane show 93% success rate with two partial failures.**
  - **One on each coast.**
  - **Local portion of overall job >90% of coating adherent, small areas delaminating.**

- **Failure analysis:**
  - **Surface cleanliness is key. Polysiloxane is not surface tolerant.**
  - **Application must following requirements in Standard Item 009-32.**
  - **Overcoat window is key. SEA 05P2 directed all suppliers to ensure ASTM-F-718s included details to preclude failure.**



Coatings must be applied in accordance with requirements

Future Reductions in Total Ownership Costs

- **Candidates for future success in NAVSEA coatings and processes to reduce total ownership costs:**

- **SEA 05 New Construction Working Group shifting good ideas from maintenance to new construction.**
  - **"Top Nine" ideas approved by NAVSEA already.**
  - **Leverage good ideas from NAVSEA, Standard Item 009-32, and industry into contractual changes.**
    Plan is to produce actual contract changes.

- **Developing high-solids, MIL-DTL-24441 to go from five coats to**
  - **One vendor's candidate product passed cathodic disbo**
  - **Resolving cracking and overcoat issues.**
    Plan is to significantly reduce steps in tank coating.

- **Coordinating with Cumbersome Work Practices, Paint Center of Exce National Shipbuilding Research Program, and others to generate successes.**
  - **Extend retention of preconstruction primer to single-coat pa**
  - **Streamline coating quality assurance process.**
    Plan is to focus all efforts on value-added processes.